



ECONOMICS OF MODERN POWER SYSTEMS

Course Overview and Introductions

Prof. Luana Medeiros Marangon Lima, Ph.D.

Agenda

- Instructor Introduction
- Students Introduction
- Course Description, Objectives
- Motivation
- Course Topics
- Course Format and Grading
 - Homework Assignments, Journal
 - Final Project
- Proposed Class Schedule



Instructor Introductions

A Little About Myself



- Born in Rio de Janeiro, Brazil
- Lived most of life in Itajubá, MG



- Got married in 2008 to Anderson de Queiroz a professor at NCCU | NCSU
- We have two teaching assistants: Clara (9 yrs) and Lucas (5 yrs)



And before you ask...



Yes! We love soccer...

My Education



- Bachelor of Science, Electrical Engineering
FEDERAL UNIVERSITY OF ITAJUBÁ, Brazil, 2005
Electrical Power Systems
The logo for UNIFEI (Universidade Federal de Itajubá) features a stylized gear or circular emblem with red, blue, and grey elements, followed by the acronym "UNIFEI" in bold letters and the full name "Universidade Federal de Itajubá" in smaller text.
- Master of Science, Electrical Engineering
FEDERAL UNIVERSITY OF ITAJUBÁ, Brazil, 2007
*Invested Cost Related Price for Transmission Use:
Drawbacks and Improvements in Brazil*
The logo for UNIFEI (Universidade Federal de Itajubá) features a stylized gear or circular emblem with red, blue, and grey elements, followed by the acronym "UNIFEI" in bold letters and the full name "Universidade Federal de Itajubá" in smaller text.
- Ph.D., Operations Research and Industrial Engineering
UNIVERSITY OF TEXAS, Austin, TX, 2011
Modeling and Forecast of Brazilian Reservoir Inflows via Dynamic Linear Models under Climate Change Scenarios
The logo for The University of Texas at Austin features the words "THE UNIVERSITY OF" in a small, orange serif font above the words "TEXAS" in a large, bold, orange serif font, with "AT AUSTIN" in a smaller, orange serif font below it.

My Work Experience

- Marangon Consulting and Engineering
2006-Present

ASSOCIATE RESEARCHER



- Federal University of Itajubá
Institute of Electrical And Energy Systems
2013-2016

ASSISTANT PROFESSOR

SYSTEMS ENGINEERING RESEARCH GROUP LEADER (2014-2015)



- Duke University since 2018

VISITING ASSISTANT PROFESSOR AT NICHOLAS SCHOOL OF THE ENVIRONMENT

ASSOCIATE DIRECTOR FOR EDUCATIONAL PROGRAMS AT THE ENERGY INITIATIVE

DIRECTOR OF ENERGY STUDIES AT PRATT SCHOOL OF ENGINEERING

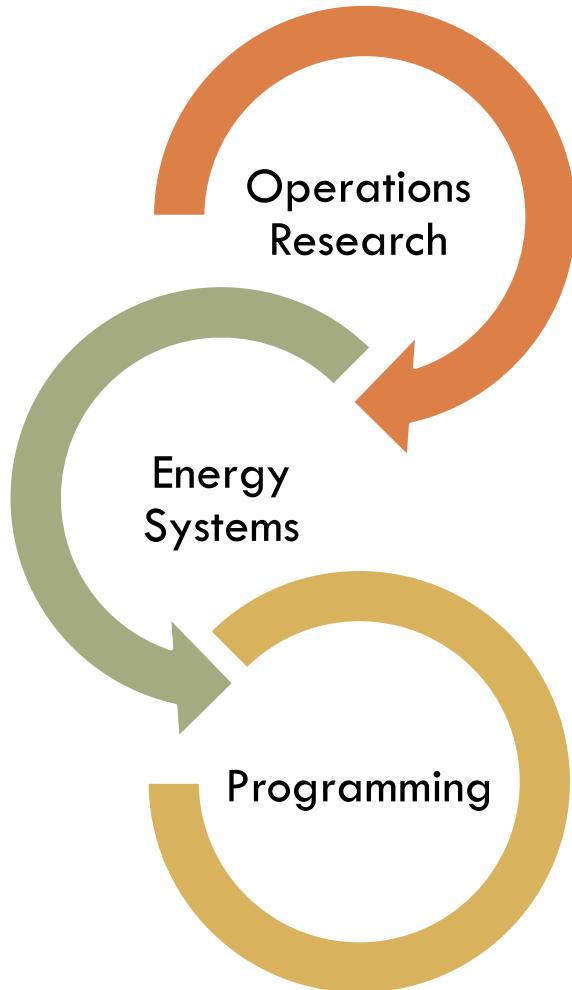
**Duke | NICHOLAS SCHOOL of
the ENVIRONMENT**

Duke | ENERGY INITIATIVE

**Duke | PRATT SCHOOL of
ENGINEERING**

My Background

- Electricity Prices
- Renewable Energy
- Hydro-thermal Scheduling
- Electric Power System Wheeling Charges
- Transmission and Distribution Planning in Power Systems



- Data Analysis
- Time Series Modeling and Forecast
- Mathematical Programming
- Stochastic Optimization
- Decision Making

- R, Python, Matlab
- GAMS
- C++, Fortran



Students Introduction



Course Description

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- Electric power grid is undergoing two major transformations or what some call a “revolution”

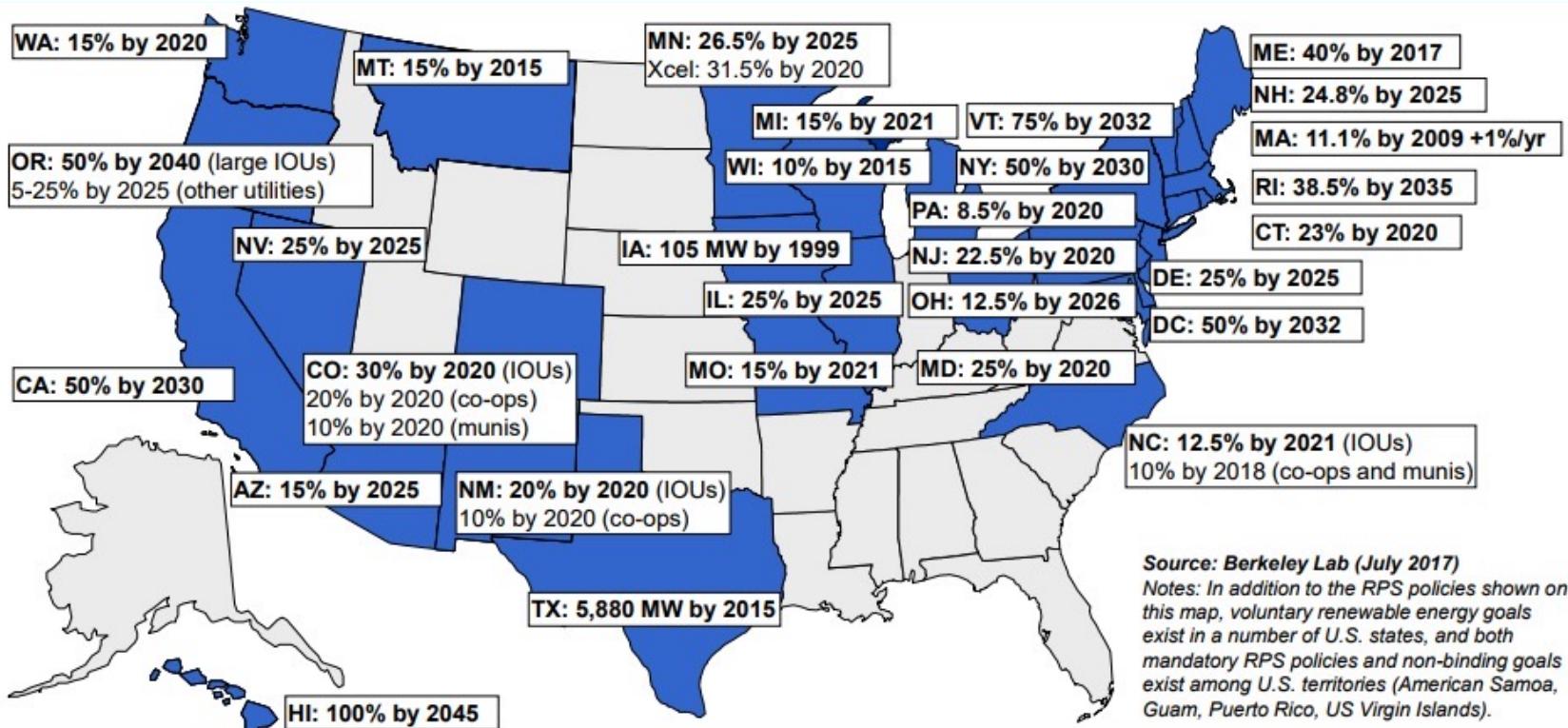
Supply Mix

Decentralization



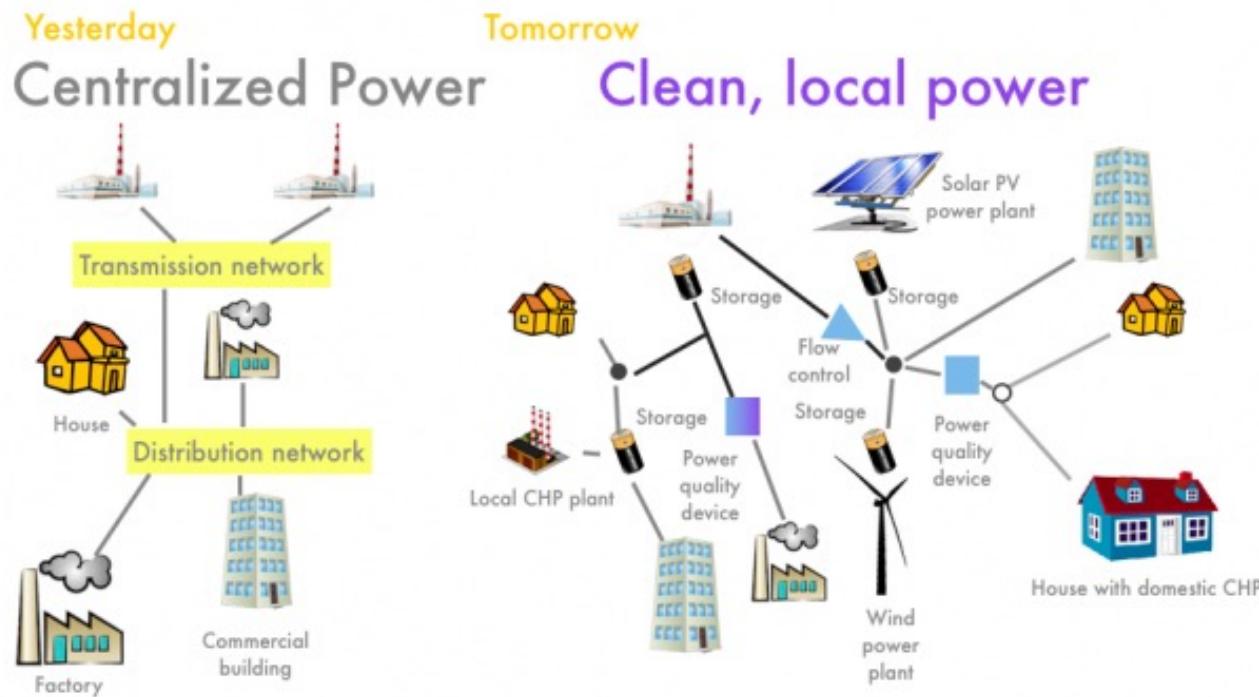
Supply Mix

- Transition away from **fossil fuels to renewables**, eventually to “100%” renewable energy



Decentralization

- Proliferation of diverse, small-scale, distribution-connected resources (DER)
- Community microgrids for resilience of critical services
- Electrification of transportation, building etc..

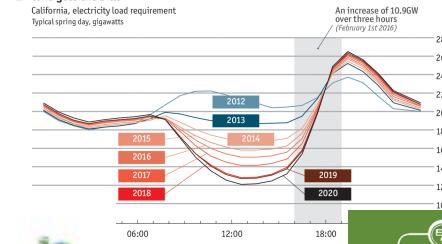


Reshaping all aspects of the industry

- Electricity demand
- Grid operations
- Planning
- Markets
- Business Models
- Utility regulation
- Capital Investment



Who gets the bill?
California, electricity load requirement
typical spring day: gigawatts



Quantifying the Financial Impact of Distributed Energy Resources on Utility Rates and Profitability

Impacts of Retail Rate Design and Net Metering on PV Economics

EE Business Models Analysis and Technical Assistance

Solar Valuation at High Penetration

Future Electric Utility Regulation Concept papers

Course Objectives

- We will talk about economics of modern power grids to facilitate integration of new agents/technology
 - Ex. Balancing supply and demand
 - Ex. Distribution network pricing mechanism
- In parallel with supply mix transition & decentralization is **digitalization**, upon competition of the course students will understand how

Information and communication technology will be incorporated into electricity generation, delivery and consumption to minimize environmental impact and improve reliability and efficiency.



Motivation

Why should you take this course?

- Many of the **challenges facing humankind**, such as climate change, water scarcity, inequality and hunger, can only be resolved at a global level and by **promoting sustainable development**
- Sustainable development is the one of the main **goals of modern society**

Economic
growth

Care for the
environment

Social well-
being

Sustainable Development Goals



One common aspect



Energy is essential to achieving **EVERY** Sustainable Development Goal

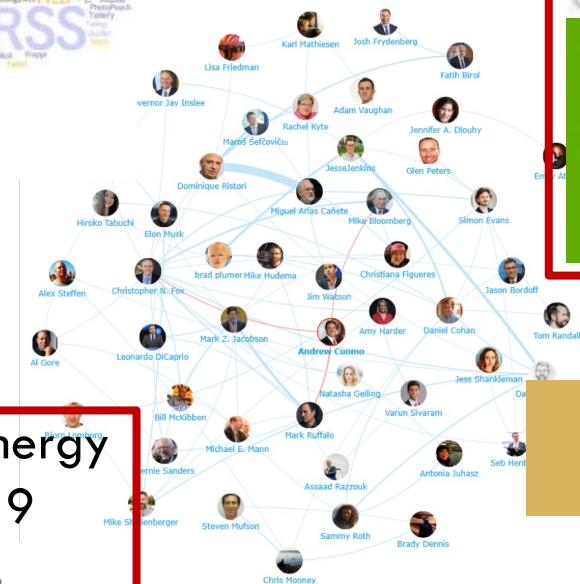
Therefore...

- Energy lies at the heart of
 - 2030 Agenda for Sustainable Development
 - Paris Agreement on Climate Change
- Aggressive goals to
 - Increase renewable participation (**Renewable Portfolio Standards – RPS**)
 - And **electrify the energy market** (50% by 2050)



Future of energy...

... invades media ...



+750 TED talks on energy
as of August/2019

TED Ideas worth spreading

Podcast channels



... and also the job market

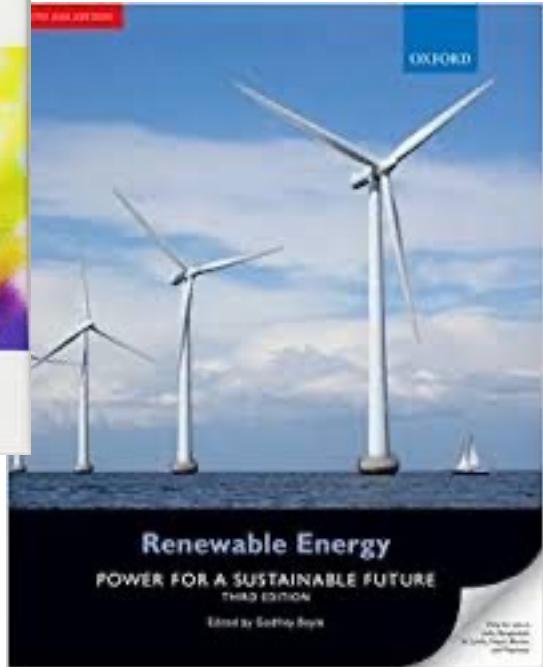
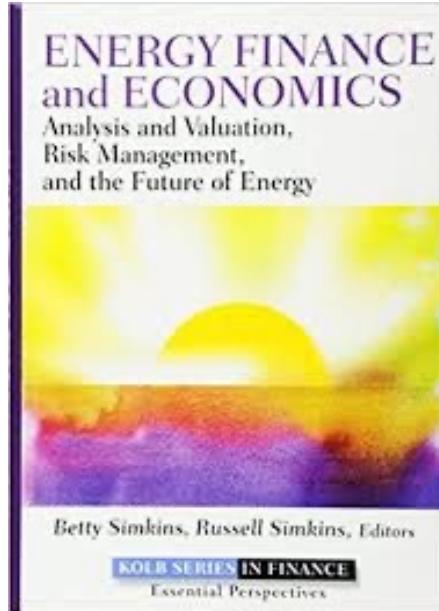
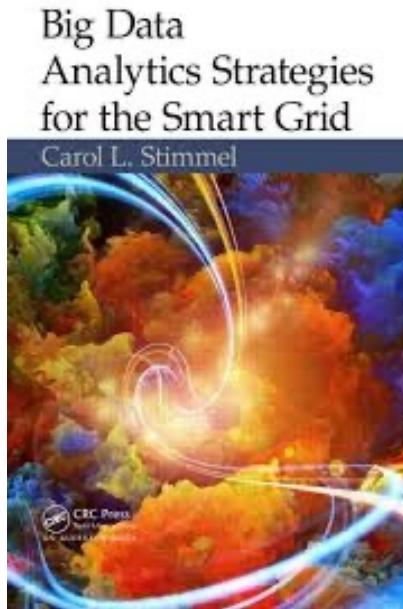
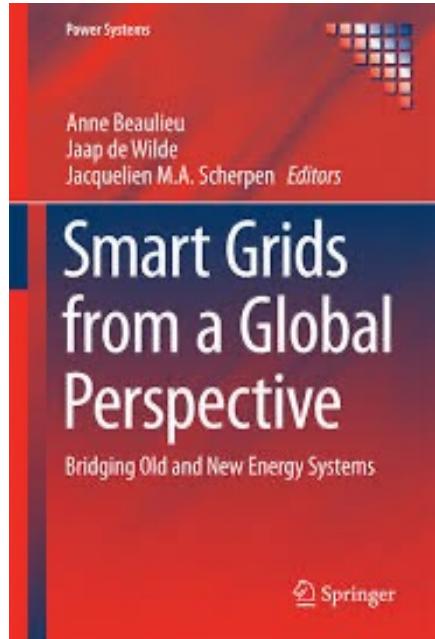


Course Topics & Proposed Schedule



- Please check the course website

Bibliography

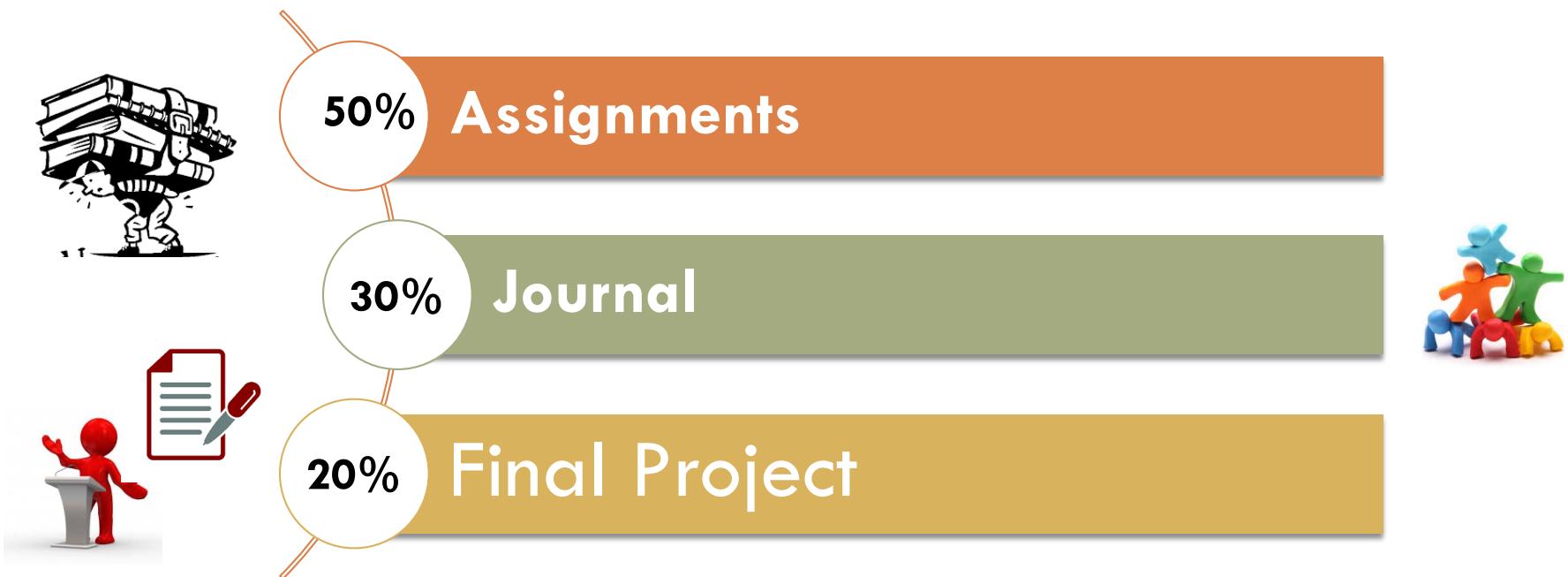


Collection of papers assigned throughout the course

We might use some podcasts as well for the assignments

Course format and Grading

- Mode: in-person class
- Weekly office hours: in-person and online options





Class Journal

- We will use Sakai forum
- On a journal week your group will either do a blog entry about what you've learned in class (or other related information) or comment on another group post
 - Entries are due on Monday by 11:59 pm
- Why? -Reflection
 - Process your thoughts, feeling and opinions about the topics we discussed



Note: There is no right and wrong for the entries. Everyone will get FULL credit as long as they submit on time

Final Remarks

- Regardless of your background, with discipline and dedication you will successfully complete this course
- Pay close attention to course objectives, requirements, and deadlines
- Do not hesitate to ask questions, we are all here to learn!
- We will use a Slack workspace for communications. I will send the invite to all students enrolled



THANK YOU !

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